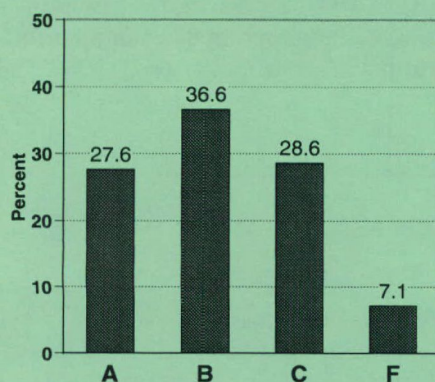


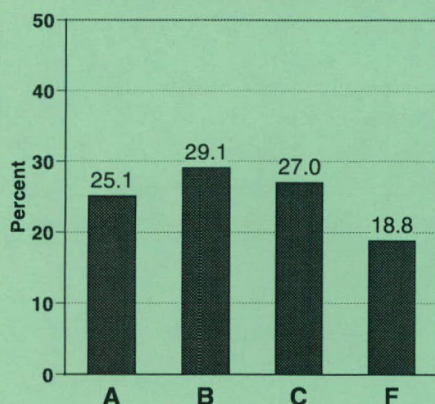
Biology 30

Diploma Examination Results Examiners' Report for June 1997

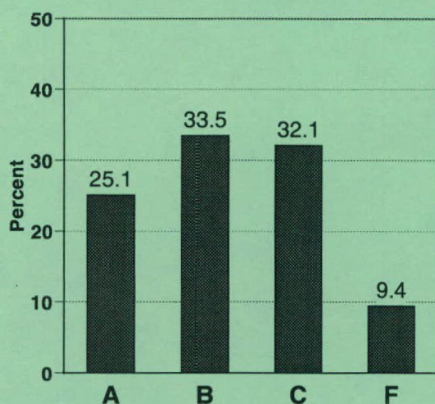
School-Awarded Mark



Diploma Examination Mark



Final Course Mark



The summary information in this report provides teachers, school administrators, students, and the general public with an overview of results from the June 1997 administration of the Biology 30 Diploma Examination. This information is most helpful when used with the detailed school and jurisdiction reports that have been provided to schools and school jurisdiction offices. A provincial report containing a detailed analysis of the combined January, April, June, and August results is made available annually.

Description of the Examination

The Biology 30 Diploma Examination consists of 48 multiple-choice questions worth 60%, eight numerical-response questions worth 10%, and two written-response questions worth 30% of the total examination mark.

Achievement of Standards

The information reported is based on the final course marks achieved by 9 022 students in Alberta who wrote the June 1997 examination. This represents a decrease of 563 students compared with June 1996 and a decrease of 344 students compared with June 1995.

- 90.6% of the 9 022 students achieved the acceptable standard (a final course mark of 50% or higher).
- 25.1% of the 9 022 students achieved the standard of excellence (a final course mark of 80% or higher).

Student achievement in Biology 30 was very good. The percentage of students who achieved the acceptable standard (90.6%) was greater than the percentage for June 1996 (88.3%). Most students demonstrated a very good understanding of human reproductive systems, hormones, cell division, and Mendelian genetics. They demonstrated a good understanding of nervous and endocrine systems and of differentiation and development. Some students had difficulty with concepts related to molecular and population genetics and the interaction of populations. The majority of students were able to describe and evaluate scientific research procedures well, and they demonstrated a very good understanding of science, technology, and society connections.

Approximately 59.6% of the students who took the course were female. Of these female students, approximately 91.3% achieved the acceptable standard on the course, compared with 89.7% of the male students. The standard of excellence was achieved by approximately 26% of these female students, compared with 24% of the male population.

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Provincial Averages

- The average school-awarded mark was 69.4%.
- The average diploma examination mark was 65.9%.
- The average final course mark, representing an equal weighting of the school-awarded mark and the diploma examination mark, was 68.0%.

Approximately 6.8% of the students who wrote the examination in June 1997 and received a school-

awarded mark had written at least one other Biology 30 Diploma Examination during the January 1996 to January 1997 period. This subpopulation (621) achieved an examination average of 59.4%, compared with 66.4% for the population (8 472) who first wrote the Biology 30 examination in June 1997. However, the group of students who rewrote increased their examination average score from 47.9% to 59.4%.

Results and Examiners' Comments

This examination has a balance of question types and difficulties. It is designed so that students achieving the acceptable standard will obtain a mark of 50% or higher, and students achieving the standard of excellence will obtain a mark of 80% or higher.

In the following table, diploma examination questions are classified by question type: multiple choice (MC), numerical response (NR), and written response (WR). The column labelled "Key" indicates the correct response for multiple-choice and numerical-response questions. For numerical-response questions, a limited range of answers was accepted as being equivalent to the correct answer. For multiple-choice and numerical-response questions, the "Difficulty" indicates the proportion (out of 1) of students answering the question correctly. For written-response questions, the "Difficulty" is the mean score achieved by students who wrote the examination.

Questions are also classified by general learner expectations.

Knowledge:

- GLE 1 Nervous & Endocrine Systems
- GLE 2 Reproductive Systems & Hormones
- GLE 3 Differentiation & Development
- GLE 4 Cell Division & Mendelian Genetics
- GLE 5 Molecular Genetics
- GLE 6 Population Genetics & Interaction

Skills:

- SPSC Scientific Process Skills and Communication Skills

Science, Technology, Society:

- STS Connections Among Science, Technology, & Society

Blueprint

Question	Key	Difficulty	GLE 1	GLE 2	GLE 3	GLE 4	GLE 5	GLE 6	SPSC	STS
MC1	B	0.774	✓							
NR1	312 or 132	0.830	✓							
NR2	4213	0.575	✓							
MC2	C	0.541	✓							
MC3	B	0.625	✓							
MC4	A	0.796	✓							
MC5	C	0.812	✓							
MC6	A	0.634	✓							
MC7	C	0.745	✓							✓
MC8	D	0.817	✓							✓
MC9	A	0.558	✓							✓
MC10	B	0.651	✓							✓
MC11	A	0.784	✓							
MC12	B	0.683	✓						✓	
MC13	D	0.388	✓							
MC14	D	0.684		✓						
MC15	A	0.692		✓						✓
MC16	C	0.881		✓						

Question	Key	Difficulty	GLE 1	GLE 2	GLE 3	GLE 4	GLE 5	GLE 6	SPSC	STS
MC17	A	0.758		✓						
MC18	D	0.814		✓					✓	
MC19	C	0.807		✓						
MC20	A	0.624				✓				✓
MC21	B	0.861		✓						✓
MC22	B	0.630			✓					
MC23	B	0.811		✓						
NR3	1342	0.593			✓					
MC24	A	0.846				✓				✓
MC25	B	0.749				✓				
MC26	A	0.784				✓				
MC27	B	0.709				✓				✓
MC28	C	0.837				✓				✓
MC29	C	0.562					✓		✓	
MC30	A	0.722					✓		✓	
MC31	C	0.539					✓		✓	
MC32	D	0.701				✓				✓
MC33	D	0.721					✓			✓
MC34	C	0.477					✓		✓	
MC35	B	0.396					✓			
MC36	A	0.723				✓			✓	
MC37	D	0.851			✓					
MC38	B	0.747				✓			✓	
MC39	D	0.884				✓			✓	
MC40	A	0.875				✓			✓	
MC41	D	0.635						✓	✓	
MC42	A	0.627				✓		✓	✓	
NR4	0.46	0.496						✓	✓	
NR5	50%	0.762				✓			✓	
MC43	C	0.636				✓			✓	
NR6	3412	0.518					✓		✓	
NR7	6.25	0.781						✓	✓	
NR8	0.08	0.494						✓	✓	
MC44	D	0.558						✓		
MC45	C	0.735	✓					✓		
MC46	B	0.633						✓		✓
MC47	B	0.644					✓			✓
MC48	A	0.578						✓	✓	
WR1		0.683								
WR2		0.467								

Subtests: Machine Scored and Written Response (Average by Subtest)

When analyzing detailed results, bear in mind that subtest results **cannot** be directly compared. Results are in average raw scores.

Machine scored: 38.6 out of 56
Multiple choice: 33.5 out of 48
Numerical response: 5.1 out of 8

Written Response: 14.0 out of 24
Question 1: 8.2 out of 12
Question 2: 5.6 out of 12

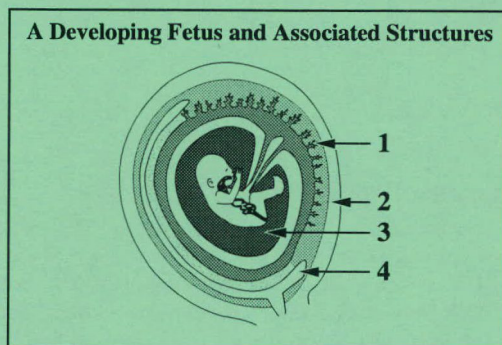
General Learner Expectations:

GLE 1	Nervous & Endocrine Systems	10.9	out of	16
GLE 2	Reproductive Systems & Hormones	6.3	out of	8
GLE 3	Differentiation & Development	2.1	out of	3
GLE 4	Cell Division & Mendelian Genetics	10.5	out of	14
GLE 5	Molecular Genetics	4.6	out of	8
GLE 6	Population Genetics & Interaction	4.2	out of	7
Skills	Scientific Process and Communication Skills	12.6	out of	19
STS	Connections in Science, Technology, and Society	10.0	out of	14

4. A person outside the gravitational field of Earth experiences disruption of normal functions of the inner ear. The region of the brain processing the disruption and the ability affected by this disruption are, respectively, the
- *A. cerebellum and the ability to walk a straight line
 - B. cerebrum and the ability to write legibly
 - C. cerebellum and the ability to hear
 - D. cerebrum and the ability to speak

6. After having a stroke, a person finds that he cannot contract muscles in his right arm and that he suffers from speech impairment. The person probably has brain damage in the
- *A. left side of the cerebrum
 - B. right side of the cerebrum
 - C. left side of the cerebellum
 - D. right side of the cerebellum

Use the following information to answer the next question.



22. During labour, smooth muscle contractions occur in structure
- A. 1
 - *B. 2
 - C. 3
 - D. 4

Multiple-Choice and Numerical-Response Questions

Multiple-choice question 4 required students to choose the region of the brain that processes the disruption of balance as detected by the inner ear and to choose the ability affected by this disruption. Overall, students had little difficulty with this multifaceted question, with approximately 80% choosing the correct answer.

Multiple-choice question 6 required students to choose the side of the brain that processes information from the right side of the body and the region of the brain that processes speech. Although the majority of the students (87.7%) correctly chose the left side of the brain, only 63.4% knew that speech is processed in the cerebrum.

Multiple-choice question 22 required students to choose the structure where smooth muscle contractions occur during labour. Overall, 63.0% of the students understood that the entire uterus was involved in labour, whereas 25.1% incorrectly thought that only the cervix of the uterus was responsible. Of the students achieving the standard of excellence, 86.7% chose the correct answer.

Use the following information to answer the next question.

The tables below represent a portion of a DNA molecule and its corresponding mRNA, tRNA, and polypeptide chain.

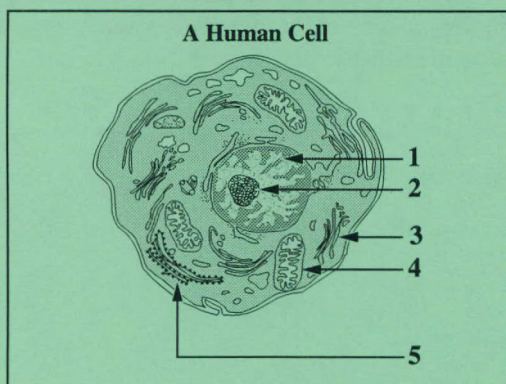
DNA:	C	G	T							
	G	C	A			T	G	A		
mRNA:			U	U		A			Y	
tRNA:						X		G	C	A
Amino acids:	W		Tryptophan							

31. The amino acid labelled W is

- A. methionine
- B. tryptophan
- *C. arginine
- D. alanine

Multiple-choice question 31 required students to choose the correct amino acid coded for by a section of unknown tRNA and mRNA but known DNA. From the information in DNA and the partial mRNA codon, students had to deduce that the complete mRNA codon is CGU, then use their data sheets to determine that CGU codes for the amino acid arginine. Overall, only 53.9% of the students chose the correct answer. Approximately 39% of the students chose alanine, indicating that they used the DNA codon (GCA) or the tRNA codon (GCA) to incorrectly determine the amino acid.

Use the following information to answer the next question.



35. Which structures in the diagrammed human cell contain DNA?

- A. Structures 1 and 3
- *B. Structures 1 and 4
- C. Structures 2 and 3
- D. Structures 3 and 5

Multiple-choice question 35 required students to choose the structures in the human cell that contain DNA. Overall, only 39.6% of the students correctly chose structures 1 (nucleus) and 4 (mitochondrion). Overall, more students (42.5%) chose the incorrect answer of structures 2 (nucleolus) and 3 (Golgi apparatus). Although structures 1, 2, and 4 do contain DNA, the only correct pairing was 1 and 4, and 63.8% of the students achieving the standard of excellence demonstrated this knowledge.

Use the following information to answer the next four questions.

Feather colour for Andalusian fowl is governed by incomplete dominance of a pair of alleles. Fowl may have black, white, or blue feathers. Blue-feathered birds are heterozygotes. In a randomly mating population of 400 fowl, there were 49 white-feathered birds.

41. The allele frequencies p (black) and q (white), respectively, are

A. $p = 0.3$ and $q = 0.7$
B. $p = 0.7$ and $q = 0.3$
C. $p = 0.35$ and $q = 0.65$
*D. $p = 0.65$ and $q = 0.35$

4. What is the frequency of the heterozygous genotype in this population of Andalusian fowl?

(Record your answer as a value from 0 to 1, rounded to two decimal places, in the numerical-response section of the answer sheet.)

Answer: 0.46

42. When a black-feathered hen is mated with a white-feathered rooster, what feather colour will the offspring have?

*A. All will have blue feathers.
B. All will have black feathers.
C. Some will have black and some will have white feathers.
D. Some will have black, some will have white, and some will have blue feathers.

5. In a cross between a blue-feathered rooster and a white-feathered hen, what percentage of the offspring are expected to be white-feathered?

(Record your answer as a whole number percentage in the numerical-response section of the answer sheet.)

Answer: 50%

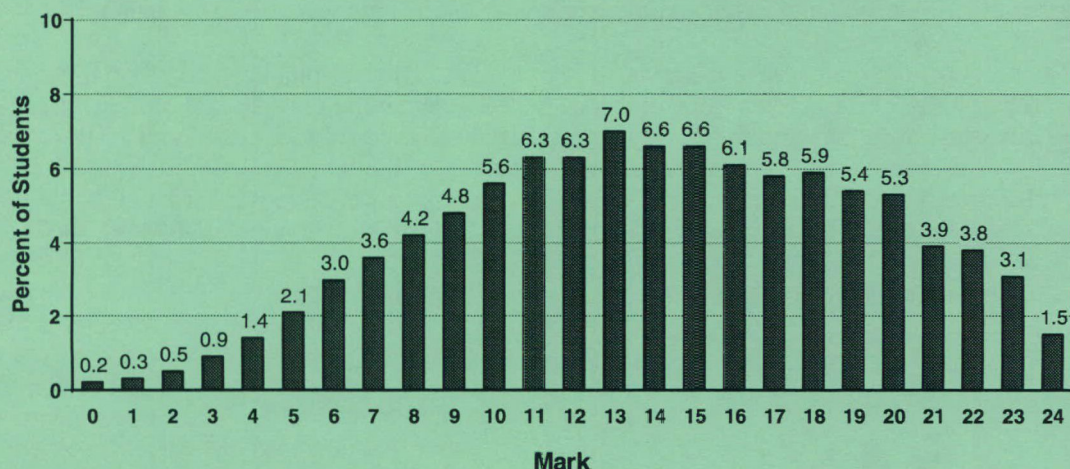
Multiple-choice questions 41 and 42 and numerical-response questions 4 and 5 required students to calculate allele frequencies, to calculate the frequency of the heterozygous genotype, to choose the predicted feather colour of offspring, and to calculate the predicted percentage of offspring of a particular phenotype. This set of questions is based on the inheritance pattern of black, white, or blue feather colour in Andalusian fowl.

Overall, students performed the best on numerical-response question 5, with 76.2% correctly calculating the percentage of the offspring expected to have white feathers to be 50%. Overall, students had the most difficulty with numerical-response question 4, with only 49.6% correctly calculating the frequency of the heterozygous genotype to be 0.46. However, of the students achieving the standard of excellence, 90.7% for MC 41, 87.9% for NR 4, 94.2% for MC 42, and 96.2% for NR 5 chose or calculated the correct answers. Although only 49.6% of the students correctly calculated the frequency of the heterozygous genotype, 63.5% were able to choose the correct allele frequencies that must be used in the calculation to determine heterozygous genotype in multiple-choice question 41.

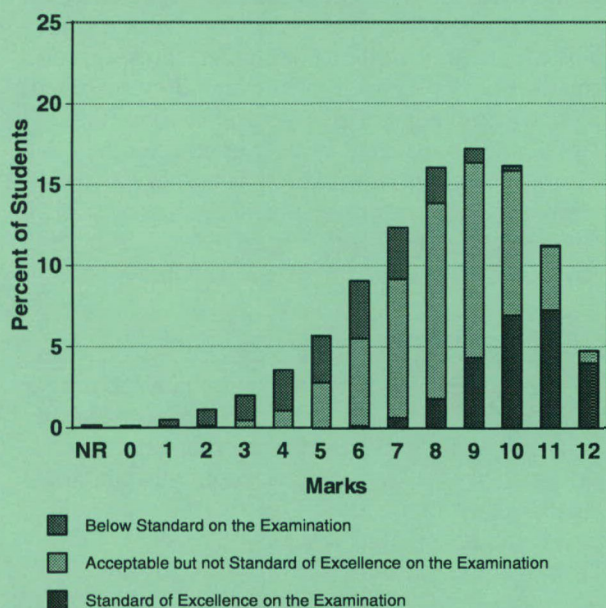
Written-Response Questions

Of the students who wrote the examination, 0.2% received no marks for both written-response questions, 67.3% received 12 marks or more out of 24, and 17.6% received 20 marks or more out of 24.

Distribution of Marks for Written Response



Distribution of Marks for Question 1



Question 1 Almost all students (99.7%) who wrote the examination received some marks on this process skill question related to the effects of maternal cigarette smoking and the birth weights of infants.

Subparts of the question required students to explain the reason for fixing variables, to graph, to make a conclusion, and to explain physiological changes.

In part a, students demonstrated that they have a clear understanding of the need for controlled or fixed variables. They especially understood the relationship between length of pregnancy and fetal weight. Some students confused maternal height for height of infant, thereby demonstrating poor understanding of the term "maternal."

In part b, most students were able to draw a bar graph that illustrated a difference; however, some students had difficulty with establishing equal scale increments and a broken scale on the birth weight axis. Many students used birth rate instead of birth weight in their labelling.

increments and a broken scale on the birth weight axis. Many students used birth rate instead of birth weight in their labelling.

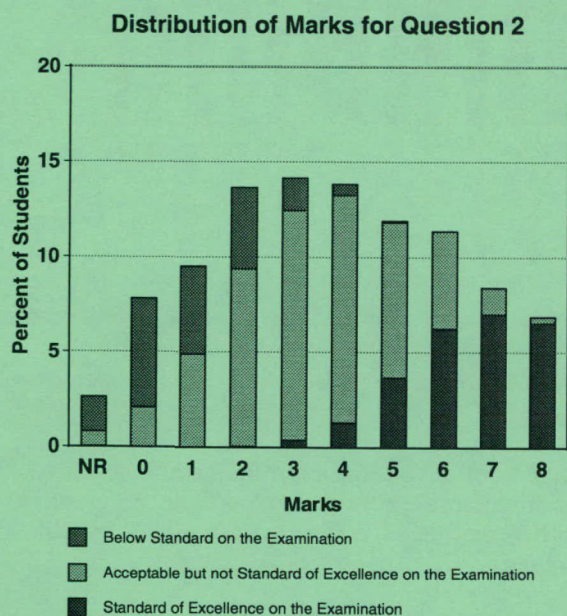
In parts c.i. and c.ii., most students were able to draw a conclusion from the available data and identify four other factors about the women's histories.

In part d, most students were able to explain how exposure to nicotine and carbon monoxide could result in reduced fetal growth. However, some students incorrectly thought that maternal blood circulates directly to the fetus or that somehow the fetus is surrounded by smoke.

In part e, few students were able to explain how the observed changes in the placenta of a mother who smokes could be a physiological response to overcome the difficulties created by smoking. Many students mistook the term physiological for psychological and many others simply did not know the function of the placenta.

In part f, many students used the information they learned on this test to influence women not to smoke during pregnancy. Some students provided only one non-smoking strategy for these women.

On this 12-mark question, the average mark was 8.2, or 68.2%. The acceptable standard on this question was achieved by 86.9% of the student population, with 32.3% achieving the standard of excellence. Of the female students who wrote the examination, 87.5% achieved the acceptable standard and 32.9% achieved the standard of excellence. The average mark on this question for the female population was 68.7%. Of the male students who wrote the examination, 85.8% achieved the acceptable standard and 31.1% achieved the standard of excellence. The average mark on this question for the male population was 67.4%.



Question 2 Approximately 90% of the students who wrote this examination received some marks on this essay question. The question required students to use the details of cell division to explain how taxol works as a treatment for cancer, to describe unwanted effects of taxol, and to explain the production of taxol. Students also had to describe benefits of and problems associated with this production, and to describe the relationship of two organisms that produce taxol.

The majority of students explained the symbiotic relationships very well. They also demonstrated a good knowledge of mitosis and recombinant DNA, and could identify unwanted effects. Generally, when required to explain or describe, many students had problems. The majority of the students developed well-organized responses that attempted to answer all parts of the question.

This question was marked holistically. Two markers read each response, and each assigned a score from 0 to 4. These scores were added to obtain a raw score from 0 to 8. This raw score was then converted to a mark out of 12. On this 12-mark question, the average mark was 5.6, or 47.0%. The acceptable standard on this question was achieved by 52.4% of the student population, with 15.5% achieving the standard of excellence. Of the female students who wrote the examination, 53.4% achieved the acceptable standard and 15.1% achieved the standard of excellence. The average mark on this question for the female population was 47.5%. Of the male students who wrote the examination, 50.6% achieved the acceptable standard and 15.4% achieved the standard of excellence. The average mark on this question for the male population was 46.2%.

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